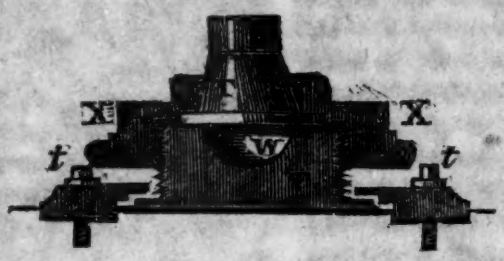
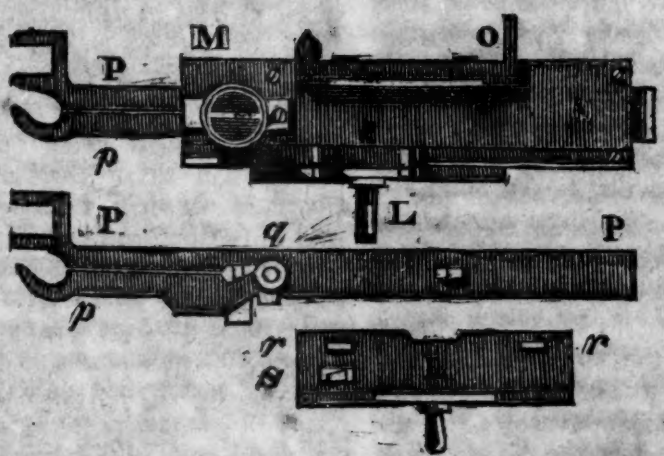
AMERICAN
MECHANICS' MAGAZINE,
Museum, Register, Journal and Gazette.

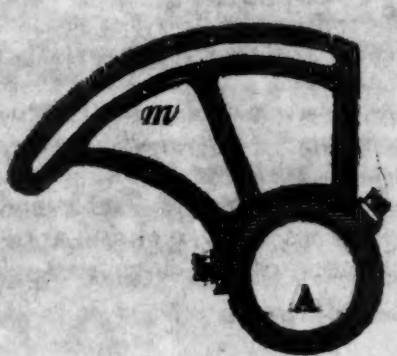
VOL. I.—No. 18.] SATURDAY, JUNE, 4, 1825. [Price $4 PER ANN.

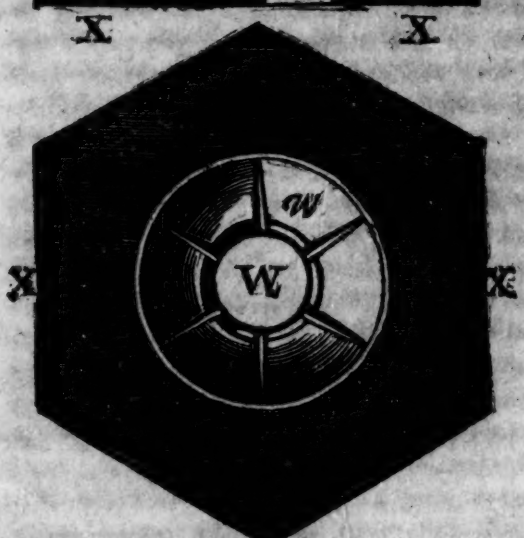
PROCESS OF COINING AT THE ROYAL MINT.

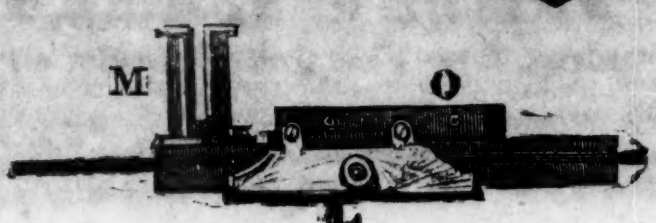
(Concluded from No. 15.)











PROCESS OF COINING AT THE ROYAL MINT.

It now only remains to show how the Coining press is made to remove every piece of money which it strikes, and to feed itself with a fresh blank piece.

HIK, fig. 1, in No. 15, is a lever, of which I is the fulcrum; it is supported on a bar, Q, fixed vertically from the cheek of the press, and steadied by a brace. The upper end of the lever is actuated by a sector, (see the fifth figure in our present number,) which is fixed upon the screw, D. When the screw turns round, the groove in the sector being of a spiral curve, will move the end, H, of the lever, to and from the screw; and the lower end, K, of the lever, being longer, it moves a considerable distance to and from the centre of the press. A socket or groove in a piece of metal is fixed to the perpendicular bar, Q, and the upper end of the lever, H, is guided in this groove, to prevent any lateral deviation.

The lever, K, gives motion to a slider, L, fig. 8, which is supported in a socket, O, screwed against the inside cheek of the press; and the slider, 8, is directed exactly to the centre of the press, and on the lever of the upper surface of the die.

Figures 2, 3, 4, and 8, represent four views of the slider and socket; N M O, is a kind of trough or socket, in which the slider runs; this slider is formed of two pieces hollowed out on the sides, which are put together, and the two pieces are held together by screws. O is the part by which the socket is fastened to the press. The slider is a thin steel plate, *p*, and this is made in two pieces, P and *p*, which are united by the joint, *q*.—The extreme end is made with a circular cavity; and when the two limbs shut together, as represented, they will grasp a piece of money between them, and hold it by the edge; but if the limbs are separated, the piece will drop out. The limb, *p*, of the slider, is opened or shut by the same movement which moves the slider endways in its socket. Thus, a plate, L, is applied flat beneath the socket, M N, and has an edge turning up and applying to the right edge of the socket. A pin is fixed into this edge, and is embraced by the fork at the lower end of the lever, K, fig. 1, in Number 15. By this means the sliding piece, L, is made to move on the outside of the socket, N. It is kept in its place by a fillet, *k*, fig. 2, which is screwed to the upright edge of L, and the fillet enters a groove formed along the upper surface of the socket, N.

The sliding piece, L, is made to move the steel slider within the socket by means of three studs, which project upwards from the bottom plate of L, fig. 4, at *r r s*, and pass through grooves in the bottom plate of the slider, so as to act upon the steel slider, P, in the manner shown in fig. 3. The left-hand piece, *r*, is received into an opening in the middle of the slider, P, fig. 3. The other two studs, *r*, and *s*, include the shank of the limb, *p*, between them, and these studs are cut inclined, so that when the piece, L, is moved to the right, the studs, *r s*, will close the limb, *p*, until they are shut, and then the studs will carry the slider forward; but, if the sliding piece, L, is moved to the left, its studs will first close the limbs, and will then draw back the slider on the top of the socket, N; a tube, M, is placed, figs. 2 and 8, and it is filled with blank pieces of coin; the tube is open at bottom to the slider, and the pieces rest upon it. When the screw of the press is screwed down, the slider, P, draws back to its farthest extent, and the circle formed at the end between its limbs comes exactly beneath the tube, M; the limbs being open, a blank piece of coin drops down into the circle of the slider; then the screw of the press, in returning, moves the lever, HIK, and the piece, L; this acts by its studs upon the moveable limb, *p*, and closes it upon the blank piece; the studs having now found a reaction, push the slider, P, forwards in its socket, and carry the piece forward upon the die, as shown in fig. 1, and which will push off the piece last struck. The screw having now arrived at its highest position, begins to descend, and the slider, L, to return; but the first action of the studs of the sliding piece, L, is to open the limb, *p*, and then the slider withdraws, leaving the piece of money placed upon the die. As the screw of the press descends, the ring, *u*, (see No. 15) rises up to enclose the piece, as before mentioned, whilst it receives the stroke, and the slider, P, at the same time returns to take another piece from the tube, M, in the same manner as before described.

Fig. 1 is a section, to show the manner of mounting the lower die for a coining press. This is used in the French Mint. V is a piece of metal or box, as it is placed upon the base of the press, and held down by a ring with screws, *t*. This holds

it fast, but admits of lateral adjustment.—In the top of the box is a hemispherical cavity, to receive the hemisphere, W; the upper side is flat, and the die, T, is placed upon it, to hold the die down; it has a small projecting rim at the lower edge, and a rim, X, is screwed upon the outer edge of the box, V, to hold the die down. The object of this plan is, that the die may always bear fairly to the money which is to strike.

Figures 6 and 7 represent a divided collar, invented by Mr. Droz, for striking money with the letters round the edge. X is a very strong piece of iron, which has a circular opening through the centre; into this six segments, *w*, *w*, are fitted, and between them they leave an opening, W, the size of the piece of money; the interior edges of these segments are engraved with the pattern or device which it is required to impress upon the edge of the piece. The segments are fitted in the piece, X, by centre pins, upon one of which pins each segment can rise in the manner of a centre.

The intention of this is to have a piece of money placed on the die within the space, W; then, when the pressure is made upon the piece, the die descends some space, and by this motion the segments close together around the edge-piece, and imprint upon the edge of it.—When all the segments come into one plane, the die arrives at a firm seat, and the metal receives the stroke which makes the impressions on its surfaces.—The die is suspended in a sort of cup, which rises and falls with the screw, nearly the same as the collar, F, in fig. 1 (No. 15.)

The money, when struck, is passed through tubes of the diameter of the different species, which readily detects any pieces which may have been improperly struck.

NATURAL STANDARD OF LINEAL MEASURE.

Sir,—From the silence hitherto observed in your valuable Magazine on the subject of a Natural Standard for Weights and Measures, it is presumable your junior Correspondents, at least, may not be acquainted with what is meant by *a natural standard*. I shall trouble you with a few lines in consequence, hoping they may excite a spirit of inquiry; first premising that a standard of length, weight or capacity, is as much a *desideratum* in science as a perpetual motion. In fact, it might be of more utility, generally, inasmuch as it might, in some measure, afford an insight into first principles, which would be a standard of truth in all scientific investigations; whereas, a perpetual motion, without our being acquained with the cause of motion, would add nothing to the correctness of science; and if such a motion were not controllable, it would answer no purpose whatever as a time-keeper or as a power.

By a standard of lineal measure, founded in nature, is meant the length of any thing which is always the same; from which to take our measures for trade, and to which we refer, to prove the correctness of those measures; so that, if these latter were all destroyed, the like could be again obtained by referring to the natural standard. Thus, were there a certain species of stones, or trees, or a single any thing whatever, that either arrived at a certain height, and was subject to neither increase nor diminution, or remained always the same in any of its dimensions, the whole or a proportion of such dimensions would constitute the natural standard, from whence to derive a lineal measure, with which at all times to compare, and from which to renew our measures, were they destroyed by accident or time.

Taking the length of this natural standard, its half, fourth, or any other proportion, we have a lineal measure for all purposes; subdivision and multiplication of the same affording inches and miles. From this, to deduce a measure of capacity, or measure for liquids, it is only necessary to take some certain proportion of the lineal measure, as the side of a cubical vessel in the clear; this proportion being established, like all others for similar purposes, by statute, there would be no difference in the vessels made for it, and no difficulty in proving their correctness. Perfect uniformity would thereby obtain in these respects throughout the kingdom, and statute measures, of all sizes, could be found by

proportions and multiples of the length of the side of the adopted measure. For weight, take the weight of the full contents of the cubical vessel of water at its maximum of density, and proportions of that weight give all inferior weights. In this manner may be obtained a measure of length, of capacity, and of weight, from having an invariable lineal standard in nature. The proposition is, where is such a standard to be obtained, all terestrial bodies being subject to change unceasingly?

Time is the adopted standard; but time is caused by motion, as we should have no idea of time could existence continue, were there nothing in motion. Time is as inseparable from motion, as motion from matter. Hence the motion of the sun in his orbit gives the time, and machines that move simultaneously with the sun are called time-keepers; the correctness of which depends on their hands pointing to the same mark on their dials every time the sun is in the same part of his orbit; which may be taken as a proof that the velocity of the sun is equal in any one orbit to what it is in another; and hence motion, or the cause of time, and time, are considered synonymous. Taking then, the length of a pendulum that vibrates with the proportion of the sun's orbit, which agrees with a second's motion of the time-keeper, that length is at present the natural standard lineal measure, from which our various measures of length and capacity, and our weights, are or may be deduced. But it has been found a matter of difficulty to ascertain the exact centre of suspension of the pendulum rod, which is indispensable towards determining the precise length of that rod; hence I would suggest the following:

From what has been stated, and due reflection, it will be found that motion alone presents the means of obtaining a lineal standard which is founded in nature; and that whatever limited motion which corresponds with any division of the correct time-keeper's motion, will afford a determinate measure of space for a standard of length. Such might be obtained from the length of a plane, down which a cylinder rolls in a second. But this affords no standard for imitation, should it be lost. On the contrary, cylinders roll down planes of different lengths in the same time, if they be proportional to the lengths and elevations of the planes they roll down; in which case there would be no knowing which is the length of the original plane that was adopted, after its loss or destruction. But as all bodies, no matter how different they are in volume or quantity of matter, fall in equal times in vacuo, might not the length of space passed through in a second be ascertained with precision; and if so, would not that length be a lineal standard founded in nature, and always attainable?

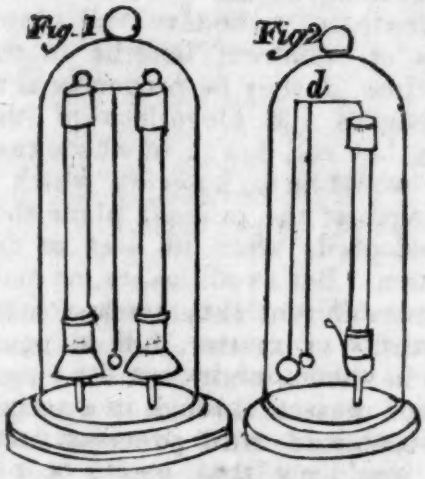
Some of your numerous Correspondents will, I hope, point out the misconceptions I may have formed on this subject, and present the matter in a clearer light to those who may be led to follow it up; as a stimulus to such I would say, that the study of motion is that of the only acting power which nature possesses, and, as such, may lead to the most sublime discoveries.

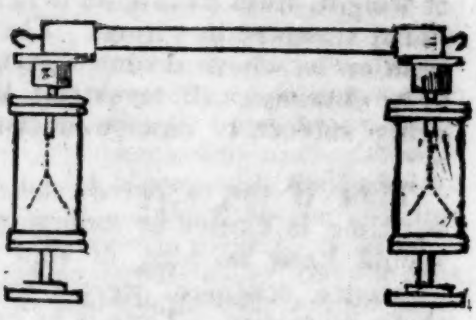
T. H. PASLEY.

ANTIDOTE AGAINST POISON.

A Correspondent of the London Literary Gazette alluding to the numerous cases of death from accidental poisonings, and particularly to the melancholy fate of the late royal academician, Mr. Owen, adds: "I may venture to affirm, there is scarce even a cottage in this country that does not contain an invaluable, certain, and immediate remedy for such events, which is nothing more than a desert spoonful of made mustard, mixed in a tumbler glass of warm water, and drank immediately: it acts as an instantaneous emetic, is always ready, and may be used with safety in any case where one is required. By a mistake, where a gentleman took a full ounce of poison instead of salts, the castors were fortunately at hand, and no doubt an invaluable life was preserved to his family by giving the mustard directly. By making this simple antidote known, you may be the means of saving many a fellow creature from an untimely end."

NEW VOLTAIC MECHANIC AGENT.





In a late number of "The Chemist," its Editor has promulgated what he considers to be a discovery, applicable to so many useful and important purposes, that it may change and improve the condition of mankind. After giving a description (which we shall subjoin) of Mr. Singer's electric columns, which produce, by the continued production of electricity, a *perpetual*, though not an equable motion, he thus proceeds:—

"This principle has only been hitherto applied to make mere toys. But the Voltaic battery, the most powerful instrument with which science has yet armed the hand of man, presents a continual renewal of the electric current, in the same manner as the pile of De Luc, but in a prodigiously more intense degree. Why cannot we apply this instrument to produce a perpetual mechanical power? The Editor believes we can, and he proposes its application in the following manner:

"All the world has lately heard of Mr. Brown's Pneumatic Engine, in which the source of the power consists in burning hydrogen, or some combination of hydrogen gas, in *atmospheric* air. Mr. Brown finds it very difficult to get rid of the *nitrogen*. But if we decompose *water* by means of galvanic electricity, as every one knows we can, we produce abundance of oxygen and hydrogen, in those exact proportions in which they combine, and, when flame or the electric spark is applied, condense each other, and produce the most perfect vacuum which perhaps the art of man can form. The Editor of The Chemist, therefore, says, that a new power, hitherto never thought of, never put to any use, may be generated by decomposing water by means of galvanic electricity, and recomposing the resulting gases by means either of flame or the electric spark. By this means we generate a power (*the two gases*) in the first place, equal to an additional atmosphere; and when we have thus generated this atmosphere, we may form a perfect vacuum by inflaming and condensing the gases. We have first a power equal to the atmosphere, which Mr. Brown does not produce; and next we have a far more perfect vacuum than he can possibly form. The volume of the gases is diminished near two thousand times. The application of this power, first to raise a piston, and afterwards to let it fall into the vacuum we create, is too obvious to need, at present, farther explanation.—Thus, by a continued production of electricity, which is generated by a Voltaic battery, we may go on for ever decomposing and recomposing water, producing, to the end of the world, an enormous power, with apparently inadequate means."

The Editor, with a liberality as rare as it is praiseworthy, adds:—

"There is no mystery, he believes, hanging over this statement—no quackery; it is plain and palpable, and such as it is he throws it open and patent to all mankind, to make the best use they can of it."

The electric columns of Mr. Singer, alluded to in the outset, are construct-

ed on a similar principle to that of De Luc, of which it may be proper to premise a few particulars.

"When bodies are broken asunder and ground to powder, opposite states of electricity are produced. In the case of metals, it is invariably found that the most oxidizable of any two metals always acquires positive, and the least oxidizable negative, electricity. If we place ever so many series of the different metals in contact, we shall not increase this effect; but it occurred to Volta, that if a series of metals were to be rendered electric by induction, there would be an accumulation of electricity. Accordingly, if we place a plate of zinc and copper with a piece of moist paper between them, we get such an increase of electricity as to make it manifest by the electrometer. A very ingenious instrument of this description is the electrical column, invented by De Luc. It consists of a great number of small plates of silver, tissue paper, and zinc, placed alternately, and enclosed in a glass tube.—When the number of discs or plates is great, as 300 or 400, the electricity which is excited becomes very sensible; and it is found that the end terminated by zinc is positive, and the end terminated by a dise of silver, negative. Such an instrument was employed by the Professor to communicate electricity to an electrometer, and it was found, by examining the electricity with a stick of sealing-wax, that with the zinc end positive, and with the silver end negative, electricity was imparted. When the opposite ends of such a pile are united, there is a constant current of electricity passing between them. If the pile be insulated, its electricity is feeble, and is increased by being connected with the earth by the hand, or rendered not insulated by any other mode. There is in this instrument then the two electric poles, and in the centre plates there is a point where there is no action whatever. It corresponds, therefore, strictly with those conductors or electrics in which electricity is produced by induction, and only differs in the circumstance of there being a perpetual renewal of electricity in the pile."

Mr. Singer's application of this principle is thus described:—

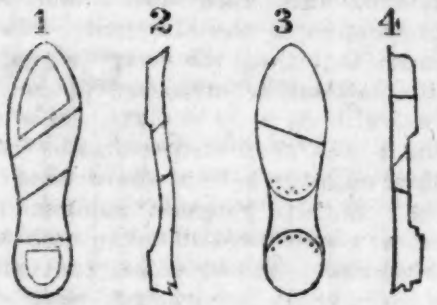
"The figure, No. 1, represents two such columns, placed vertically in a glass receiver, having a bell fixed at the lower extremity of each, and having a brass ball suspended between them, by a very fine thread of raw silk. Mr. Singer, who constructed this apparatus, found that the production of the electricity was so continual, that the bells never ceased to ring for fourteen months, except during its removal from place to place. For six months it was never disturbed, and there was then no interruption whatever to the ringing. In Mr. Singer's opinion, the action of a well-constructed column will be permanent; he had some, that after being three years constructed, were still as active as ever. To keep it in good order, however, the two ends should not be connected by a conducting substance for any length of time; and it is therefore necessary, when a column is laid by, that it be placed on two sticks of sealing-wax, so as to keep its brass caps about half an inch from the table. A column, which appears to have lost its action from lying by, will generally recover its powers when insulated in this way. Too much moisture also destroys it. An increase of temperature increases its power. In winter, Mr. Singer's bells always ring slower than in summer: and when a fire is made in the apartment, the action always increases.

The aerial electroscope is an instrument for determining the electric state of the atmosphere, and this is another use to which De Luc applied his column. It is placed vertically within a glass receiver, and consists of from one to two thousand series. A bent wire, having a ball at its lower extremity, is connected with the upper extremity of the column, so as to hang parallel to, and at some distance from it; opposite to it is a similar ball, screwed into the lower cap of the column a brass fork prevents the first ball from striking against the column, which it would otherwise do. The pendulum consists of a fine silver wire suspending a gilt pith ball.

TO PREPARE THE PEARL AND WOODASH LEY USED IN CLEANING PICTURES.

Let an ounce be dissolved in a pint of water, to be stirred frequently, for half a day, and then decanted from the settlings. This is used warm, with a sponge, and with great caution; when thick spots are not easily removed, a strong soap lather may be of use, not suffering it to touch any other part of the picture but the spot it is to be engaged with. *Mec. Reg.*

WOODEN SOLE BOOTS AND SHOES.



Mr. James Holland, of Aston, Co. of York (England) manufactures boots and shoes, with woodeu soles, furnished with hinge joints. The leather welts are folded over the edges of these wooden soles, and made fast by nails or screws.—The particular construction of these soles are shown above.

Description of the Engraving.

Fig. 1 represents the under side suited to a man's foot, and

Fig. 2 is a (longitudinal) section of the same. There are hinge joints at the transverse lines, for the purpose of giving flexibility, that the sole may bend, and accommodate itself to the motion and foot of the wearer. The sole should be made of light tough wood, boiled in lime water, and then be soaked in (drying) oil.

The inside of the sole may be covered with a piece of cloth steeped in tar or varnish, to render it impervious to water. The uppers are made of leather in the usual way, only the welts are a little wider. Iron tips may be attached to the toe and heel, when it is to be considered finished.

He also proposes a different construction, as shown at fig. 3, of which fig. 4 is a (longitudinal) section. The toe part is of wood, so also is the heel part; but the middle is to be made of leather; a hinge joint is to be formed at the transverse line in the toe part, for the same purpose as above stated; and the thick substance of leather in the small of the foot (attached to the wood by screws or rivets) is to afford elasticity. There is a small groove cut on the upper edge of these wooden soles, for the reception of the leather.

These boots and shoes are stated to be twice as durable as those commonly made with leather soles; are capable of being finished with equal smartness, and are not in any degree inconvenient to the wearer.

Journal of Arts and Sciences.

The above improvement in the manufacture of boots and shoes appears to be worthy of adoption in the United States for common purposes. Wood constitutes very durable soles, particularly the beach and curl'd maple of our forests; they conduct heat very slowly, and if they be well steeped in boiled linseed oil, they would become impervious to water, and the intervention of canvass, varnished with the same oil, between the wood and lining, or inner sole, would keep the feet perfectly dry. These shoes may be made over iron lasts, and the wood parts attached with small nails, which would give them a more neat and light appearance; besides, in this way they could be made with greater expedition.—Ed.

GALVANISM.

Sir,—Galvanic Electricity is an interesting subject, not only in a philosophical, but in a medical point of view, as it is represented to be the most efficient stimulant at present known for the removal of disorders indicating a general or local deficiency of nervous energy; such as palsy, deafness, obstinate costiveness from torpidity of the liver, &c.—The professors of galvinism, &c. hold out expectations of removing such disorders, by six weeeks' application of this philosophical remedy, at, I believe, a guinea per week. Now, if to this be added the expense of a residence in London, your mechanical readers in the country will obviously, for the most part, be utterly unable to avail themselves of a remedy, however real, so dispensed; and if they read the books which have been published on such subjects, they will find some of them, at least, less calculated to teach them the proper mode of applying galvanism, than to point out the residence and the successful practice of galvanian doctors.

Such being the case, perhaps the less opulent among your readers may some of them be gratified to learn the fundamental principles of galvinism at a small expense; and such is the object of the present communication, both with respect to myself and others.

A galvanic trough may be made of beach, well dovetailed together, and painted, both with a view to preserve the wood, and to insulate the galvanic fluid: all oily and resinous substances being non-conductors of electricity. In the sides and the bottom of the trough must be made grooves, about one-eighth

of an inch deep, to receive the edges of the galvanic pair of plates, and to retain them firmly in their places, leaving spaces between them not exceeding three eighths of an inch.

The inside of the trough must be covered with cement—as one part bees'-wax, and two parts resin; and the plates must be put in when both they and the cement are hot, so as completely to insulate the cells or spaces between them. A hot wire, or other convenient instrument, must be used to perfect the cementing process: and the cement must finally be scraped from the sides of the plates, as it may be presumed their power is diminished in proportion as they are covered by a non-conducting substance.

The pairs of plates, as most of your readers may be aware, consist of zinc and copper soldered together, at least along their upper edges, which are exposed to view, the other edges being covered by the cement.

The copper plates may be almost as thin as possible; the zinc plates being most exposed to oxidation, I imagine they ought to be from 1-16th to 1-12th of an inch thick; they may be cast, or obtained in plates. In placing the double plates in the trough, care must be taken that all the similar metals may be to the right or left, so as to form a regular series of copper, zinc—copper, zinc, &c. alternately.—This being done, when the cells are nearly filled with water, acidulated with (say 1-30th part) of sulphuric or muriatic acid, the positive electricity will accumulate toward the zinc end of the trough, and the negative electricity will be exhibited, of course, at the opposite extremity. The sides of the trough should be raised nearly three-fourths of an inch above the tops of the metallic plates, to facilitate the pouring on and regulation of the acidulated water, and the trough should be well rinsed when put aside, to prevent any unnecessary oxidation of the zinc plates. The trough being charged, the galvanic influence, either in shocks, or a continued current, may be passed through the body in various directions (even at the same time) by metallic communications with any of the cells towards the opposite ends of the trough. As the epidermis, or outer skin, *when dry*, is a non-conductor of galvinism, it should be *soaked* with a solution of salt and water, by means of a wet sponge, or leather, or metal plates covered with leather, and bound to the body, when necessary, by fillets, &c. The effects will be found very different, according as the parts operated upon are more or less sensible or muscular. Flashes of light will appear in the eyes, and a peculiar taste will be perceived, if almost any part of the head be galvanized. Operators should be careful not to pass more than the power of ten or twelve plates, at first, through the ears, as they will find it produces a very peculiar, though generally a momentary sensation of giddiness.

Now, as my object is partly to give and partly to obtain information, I hope some of your more experienced and intelligent Correspondents will be so obliging as to answer the following queries, and to communicate any other information on this subject which they may deem interesting to your readers in general:—

What is the usual size and number of the plates employed in medical galvanism? Wilkinson, in 1804, employed fifty or sixty pairs.

Is there any better mode of conducting the fluid through the skin than what is described above? I propose this query, because some professors hold forth the expectation of administering galvanism without causing any *pain* or uneasiness. Whether this can be performed by any other means than using few plates, and such as are of small dimensions, I know not; but it is a fact, that a series of thirty double plates, two inches square, often cause a pungent pricking sensation in the skin, in some parts, which few would choose to endure for many moments in succession.

As the magnetic influence has an evident alliance with galvanism, and as they have been used in conjunction to produce some curious rotatory machines, I beg to ask your philosophical readers, whether any circular galvanic troughs have been constructed, with a view to prove whether, if suspended, the influence of a magnet would cause them to rotate?

Is it known whether a large series of magnets, immersed at their extremities in separate glasses of pure or acidulated water, after the manner of Volta's experiments, exhibit any galvanic power on connecting their extremities with the interposition of parts of living animals, &c.?

Professor Hare, of Pennsylvania, states that the galvanic power is much increased, even without insulation, by enclosing plates of zinc in a kind of copper case, open at top and bottom; and Sir H. Davy has proved that a *small* plate of iron or zinc will prevent the corrosion of a *very large* surface of copper exposed to the

action of sea water. The consideration of these circumstances induces me to ask, whether it has been proved by experiment how far the thickness, or the extent of surface, of the copper plates, influences the galvanic power, independent of a correspondent alteratfon in the plates of zinc?

The *modus operandi* of the galvanic fluid seems to me to be so completely unintelligible, that it may be reasonably presumed, that great discoveries yet remain to be made in this line by those who make it their ambition to pry into the mysterious secrets of nature.

I am, Sir, yours, &c.

T. B.

RAISING WATER BY WIND.

SIR,—At one time of my life I entertained strong and grand opinions of being able to discover the perpetual motion, which, I need scarcely mention, I have not yet effected; but I have this satisfaction to boast of, that my time and labour were not thrown away, as I learned much from my own misconjectures; that is, by persevering until I discovered wherein my errors of opinion consisted. I was inclined to think the discovery was to be made by hydrostatic means, and while under that impression, conceived that water might be raised by atmospheric pressure with less expense of power than is generally the case. It occurred to me that the pressure of the air on the top of an open tube might be diverted out of its vertical direction by means of a current of wind; and this conjecture was supported by the fact, that the pressure of the waters of the ocean is no hindrance to currents of water running in all directions through the sea as the Gulph Stream which crosses the Atlantic Ocean affords sufficient evidence. To put the matter to the test of experimental proof, I filled a saucer with water, into which I put a glass funnel, the smaller orifice being above the water about eight inches; then, having an assistant to blow a pair of kitchen bellows, so as to make the wind pass over the top of the tube, we effected the desired object. I held the tube of the funnel with my hand grasped round it, and let the nose of the bellows rest on the side of the uppermost finger. While the operation of blowing went on, my assistant raised and lowered the bellows as I gave directions; and, with the hand on which the bellows-pipe rested, I humoured the direction of the pipe, so as to prevent the wind descending to the water in the funnel, and to cause the entire of the orifice of the funnel to be included in the blast which was passed over it. The result was, that the water ascended in the funnel, filled it, and was blown over as long as the operation of blowing was continued. I next tried a thirty-inch barometer tube, open at both ends, and the result was as before, only the water started up with much greater rapidity than with the funnel. The reason is obviously the insufficiency of the blast of a pair of small bellows, and the difference in quantity of air to be removed from within the tubes. I tried the like experiment with a pair of smith's bellows; but these being fixed to the fire, the blast was conveyed from them through about eight feet of lead pipe, the length of which, from the bellows, caused the wind at its exit to have little or no effect in removing the air's pressure. These hints may possibly be improved on, for which reason it is I request you will be pleased to lay them before your readers; in a future paper I may continue my observations on removing atmospheric pressure by the wind.

JERNIGAN.

TO IMPROVE GUNPOWDER FOR BLASTING.

SIR,—Having, some time since, had occasion to make some trials of the strength of different samples of gunpowder, and ruminating on the phenomenon of expansion of air, the accounts illustrative of which I consider no way satisfactory, the ideas I formed on the subject led me to the conclusion, that oil added to gunpowder might possibly increase the expansive power of the latter; and, upon trial, this appeared to me to be the case. I half filled a tin cylindri-

cal two-ounce snuff canister with gunpowder, on the top of which I poured some locksmith's oil; then, with the cover on, I shook the powder until the whole had become similar in colour, and no appearance of moisture remained. On comparative trials, I found the oiled powder stronger than the same powder not oiled. But, not having a regular powder proof, I was obliged to decide to the best of my judgment, which may possibly have been influenced by an inclination to flatter myself that I had fallen upon a discovery that might be productive of some general good. I am of opinion, from the appearance of the oiled powder, after long keeping, and although excluded from air, that it deteriorates faster than powder not oiled. I judged so from its effects in the fire, as well as from its novel whitish appearance, as if some small degree of efflorescence had taken place, which, if so, would be greater in a less confined situation. But, if the conjecture be not altogether imaginary. that *newly* oiled powder is improved by the process, it is probable some advantage might be taken of the hint in the application in mining, but most particularly in the blasting of rocks. Being, in several instances, much indebted to the liberal communications of your Correspondents, I take this opportunity of throwing in my mite in return, and shall be most happy at all times, as recollection serves, and circumstances present, to communicate whatever may appear likely to be anywise useful—"for good communicated, more abundant grows."

I am, Sir,

Your obedient servant,

ETCETERA.

DYEING IVORY SCARLET.

Make a ley of wood ashes, of which take two quarts; pour it in a pan upon a pound of Brazil wood; to this add two pounds of copper filings, and one pound of alum; boil the whole half an hour, then take it off, and let it stand; into this put the ivory, and the longer it continues in this liquor, the redder it will be. The same process and dye will do for bone, and will make either of a fine coral red.

A. B. C.

PERPETUAL MOTION.

Dec. 1813.

SIR,—The theory of a finite quantity of matter being composed of an infinite number of particles, as to the truth of which mathematicians are divided in opinion, may, perhaps, be compared to that of perpetual motion. For mathematicians, on the other side, say it is a contradiction to suppose any thing of finite dimensions can be composed of infinities, which certainly appears correct in principle; yet, on the other hand, it is argued, that no certain number of parts of which any matter consists can be supposed, without having an idea of a greater number, even *ad infinitum*. On the same ground, although no certain time can be pointed out which forms the maximum of the movement of machinery, nor can any length of time be conceived without an idea of greater extent, to which, by increasing either the moving power, or the complication of the inferior parts, the motion may be carried; yet perpetual motion, as a mechanic principle, is visionary.—Query—will this at all explain the subject which has been so long controverted, as it proves the maintainers of both sides of the question to be to a certain degree right?

This argument, of course, alludes to engines, where a mechanical power is the moving force, and not a chemical power, as the electrical pendulum.

I am, Sir, Yours, &c.

ESPERANCE.

RAIL ROADS AND LOCOMOTIVE STEAM ENGINES.

Every body has heard of Rail Roads and Locomotive Engines, but there are few who have had such a description of the latter as will enable them to judge of their value.—We gave an engraving in Number 13 (Am. Mec. Mag.) of an engine in

full operation upon a rail road, dragging several carriages. The limits of our paper do not permit us to give the entire number which one of these engines is capable of drawing; but we understand that ten coaches or galleries, connected by chains, and carrying each from eight to twelve persons, with luggage, can be drawn at the rate of ten or twelve miles an hour over an iron rail road, without the slightest danger of accident.

The rail road question is one which will agitate the British Parliament and the country. It involves many private interests, an enormous capital, and much public consideration. We will not add to what we have said in favour of the principle. Our observations arose from our conviction of the importance of the improvement in the mode of conveyance of persons and merchandise, because we feel that much of our greatness as a commercial country has been produced by the improvement of the canal over the common road system of conveyance; and we imagined from all that we had heard and seen, that just so much as canals are better than common roads for the conveyance of goods, rail roads are superior to canals, with this additional advantage, that in the one case only goods can be conveyed, owing to the tediousness of the journey, in the other passengers might proceed with equal or greater speed, and much greater convenience. We are aware that many objections, some of them important, may be advanced against the general construction of rail roads, and the use of locomotive engines; but what public improvement was ever introduced to which in the first instance objections were not offered? The greatest objection, in our opinion, is, we think, the injury which the new principle may inflict upon the proprietors of canals in districts where it is proposed to lay down rail roads; but some plan may surely be devised to compensate these persons for the loss which they might sustain. Notning could be more reasonable, and the projectors of the rail roads, after the statements which they have made in their prospectuses of the enormous profits to be derived from them, and the greater part of which would probably be realised, cannot object to such a compensation. Upon the broad principle of public utility we frequently consent to sacrifice private interests. This principle, however, ought not to apply in the present instance; because, when the proprietors of Canals obtained the sanction of the legislature to their construction, they never could have contemplated the possibility of infringement, and therefore embarked their capital with an assurance of permanent security, which, or a compensation in lieu of it, they have now a right to demand. We doubt not that the legislature will act wisely and justly on the discussion of this important question, neither turning to the right nor to the left, but acting for the interest of the public, the credit of the country, and the fair encouragement of science. The enormous price of iron, and the still more enormous price to which it would rise if all, or even half, the projected rail roads should be laid down, have been brought forward repeatedly as objections to the plan. We might as well say that only one portion should eat bread, because increased consumption would increase the price of flour. In the one case we should answer,—Whilst there remain many thousand acres of land uncultivated, and our ports are open to receive foreign corn, the price of flour can be regulated by a fair standard. In the other we say,—Whilst the bowels of the earth remain unexplored to the extent of many hundred miles, in quarters where iron stone may be presumed to exist in abundance, and our ports are open to the introduction of foreign iron, there can be no danger of such an increase of price as ought to deter us from a public improvement, under the dread which our alarmists would instil into us.

Mr. Gray, after some general remarks upon his proposed system, says,—"Why may not the same facility and despatch be given on land, as we now find in practice by steam boats from Dover to the Continent, and from other ports of the United

Kingdom? By means of rail ways and steam engines, the same, if not superior advantage may be enjoyed throughout England, Ireland, and Scotland, as a general and uniform conveyance to all commercial towns and places of any importance.

"In order to establish a general iron railway, it will be necessary to lay down two or three railways for the ascending, and an equal number for the descending vehicles: the wagons laden with merchandise can never be expected to proceed with the same velocity as coaches, but they should all be built on exactly the same plan, as to width, which would prove extremely economical by affording the same accommodation to all: for carriages going with a greater speed, may, on coming up to any other, pass off into the next track, and fall again into the first track, by which method any carriage of superior speed may continue its course without any obstruction.

"The sums quoted, as the expense of railways, vary too much to be depended upon; but by following the middle course, we may, perhaps, be nearer the mark. I shall, therefore, take the sum of one thousand pounds per mile for the single railway: the present plan, as above mentioned, requiring six railways, will consequently cost six thousand pounds per mile."

Before we proceed with our quotations from Mr. Gray's pamphlet, it will be necessary to premise that his project is for a general railway, which he estimates at two thousand miles. We have no means of ascertaining correctly the number of miles over which it is proposed to lay iron railways by the different Companies which have been formed, nor of the expense of their construction. The latter is stated variously, from four to ten thousand pounds per mile, according to the nature of the country through which it is to run. Mr. Gray's calculation is therefore probably pretty near the mark.

We shall proceed with our quotations, adhering to his principle of a general railway of 2000 miles only for the purpose of showing the total expense, according to his own calculation, and also the general advantages and disadvantages of the system.

"If (says Mr. Gray) we take the draught of the plan, for Great Britian, as given in this pamphlet, for our guide, and allow for a few branch railways, which may still be added thereto, the number of miles will be about two thousand, which, at the rate already stated, will amount to twelve millions sterling; supposing that double, or even treble this sum be demanded, it would be found, that the present revenue drawn from the public roads, the great expense of their repairs, and the enormous sums of money expended in the purchase and keep of horses, will sufficiently demonstrate the abundance of wealth this new scheme would yield to its subscribers.

"I feel assured, that the total expense of the purchase of horses might be completely saved, and that the annual expense of their keeping alone would more than provide for the steam engines necessary for this new projection, as well as defray the whole annual expense of repairs on a general iron railway; it should also be remarked, that as the journeys would be performed nearly in one half the time, the proprietors of steam coaches and wagons would considerably augment their receipts for conveyance of goods and persons, and at the same time diminish the charge to the individual.

"The conveyance by coaches, wagons, and post-chaises, must ever prove expensive as at present, even in the most favourable times, arising from thegreat prices paid by the proprietors for horses, the precarious existence of these animals employed in coaches and post-chaises, and the intolerable expense of their food.—These several points, duly weighed and impartially considered, will be found the real cause of those heavy charges made on the public, and convince everyreflective mind of the impossibility of any reduction. The very great cruelty inflicted on coach and post-chaise horses has long called forth the commiseration of the hu-

mane; and in a country where every nerve has been exerted to abolish the slave trade, it is hoped that the same national feeling may be excited in behalf of these poor dumb animals; the plan here proposed will not only diminish these acts of cruelty, but also present a more expeditious and considerably cheaper conveyance; even where horses shall be made use of; the strength required would be comparatively trifling to the present system, as the coaches running on the railway might convey three times the weight of luggage, and passengers in like proportion, with half the horse power."

"One great advantage," says Mr. Gray, "which would arise from the use of locomotive engines would be the very great quantity of land used solely for the keep of horses, which might then be cultivated for the growth of corn and vegetables; if the land now required to raise food for these animals could be converted to the use of man, the number of human beings which might be supplied, by this alteration in our national economy, with the means of existence, would be very considerable indeed."

The succeeding observations we consider important. To us it seems that there can be no danger from the use of the steam engine upon iron railways, and that there must be much pleasure and convenience.

"Mechanic power, when once put to the test, by comparison on land and water, will, no doubt, prove more favourable by the former, in proportion as that element is more stable, and not under the influence of wind, tides, or currents; besides, the preference given, by the generality of mankind, to land carriage, the misfortunes which might happen to steam vessels cannot affect the steam coaches or wagons, as the steam engine on land is a separate vehicle, and only connected with the coach or wagon by a bar or chain."

"A general iron railway," says Mr. Gray,* "would prove one of the most important branches of political economy, by introducing a system of conveyance every way superior to our present establishments, and at the same time presenting a fair opportunity to ministers of improving the finances of the country. Many millions of capital now annually required and expended in horses and their provender to keep up our present internal intercourse, might, besides augmenting the revenue of the country, be diverted into other channels of profitable employment, and various improvements in every country. One half the time and expense might be saved to the public, in forwarding and receiving the outward and homeward bound mails to and from Falmouth, and other ports whence the packets sail. The most effective communication might be established between all outports throughout the United Kingdom and the Admiralty, which would not only prove highly beneficial to our commercial interest, but in time of war considerably accelerate operations against any enemies that might present themselves on our coasts.

In time of war or civil commotion, troops might be despatched from one end of the island to the other in one quarter of the time now required.—Provisions and equipments might be forwarded to outports with the greatest speed and facility on fitting out an expedition.

The great mortality amongst horses employed in coaches and post-chaises, is so very general as to admit of no dispute; and it is equally evident to every individual, that the public must bear this expense, as no proprietors of stage-coaches or post-chaises could bear such an immense and continual loss, were they not secured by fares, and rates of carriage, in proportion to the risk; taking the number of horses now employed in coaches and post-chaises *only*, to be

* No scheme for a general railway is before the public; but if all the rail road projects already brought forward, and those which are to be brought forward in the event of the bills now before the House passing into law, be put together, we shall find Mr. Gray's idea of general railway completely realised.

100,000, and each horse to average in value 20*l.* the net amount is two millions sterling; this sum (agreeable to the statements made by several of the first coach proprietors) is completely sunk within the short space of six years—every six years! and the very same amount, two millions, is annually expended in the keep of these animals, reckoning the same average sum of 20*l.* a head * No immediate reference has hitherto been made to horses employed in stage-wagons; there can be no doubt that the number is considerable, and that the expense of first purchase, together with the daily expense of food, will bear a relative proportion to those employed in coaches; for the present, this short remark will be sufficient to convey the idea, that the sum already given, as a calculation of the aggregate number of horses employed in England, is far under the mark."

We regret that our limits will not allow us to follow Mr. Gray through all the arguments which he advances; the table with which we must conclude our quotations from his work, is, however, so curious, that we give it entire.

"An abstract statement of the comparative difference between horse and mechanic power.

The real number of wagon, coach, and post-chaise horses employedon ourmain turnpike roads, will, perhaps be found to exceed 500,000; taking, however, this number for a calculation,and computing the value of each horse at 20*l.*—the keep at 20*l.* each per ann. In the course of twelve years, allowing for the renewal of stock every four years, and the interest of capital, the consequent expense in this limited space of time is 173,500,000*l*		
The expense of 10,000 steam engines, 300*l.* each in value, which would, on a railway, be more than equivalent to the horse power, above stated, amounts to		3,000,000
Interest of this capital for twelve years		1,800,000
The fuel necessary to feed the steam engines taken at 14*s.* per day for each engine, in twelve years amounts to	30,660,000	35,460,000
		138,040,000*l.*

The following extract from a very useful philosophical work will be read with interest, as it contains most valuable practical information on the subject which we endeavour to illustrate.

"The origin of rail roads may be traced back to the year 1680. About that period coal came to be substituted for wood as fuel in London and other places; the consequence was, that at the mines the greatest inconvenience accrued in conveying the coal from them to the ships, as well as immense expense in horses and machinery for the purpose; to remove which, wagon roads were made, consisting of wooden rails or ledges, which the wagons were formed to move upon, and from out of which improvement it was found that a single horse could easily draw a wagon on these rails, which previously required three or more horses to be employed to effect by the common roads; and it was also drawn more quickly, arising from laying down the frames upon an easy descent, which was always done.

"In 1738, this improvement was farther improved, by substituting cast iron rails instead of the old wooden ones; but owing to the old fashion wagons continuing to be employed, which were of too much weight for the cast-iron, they did not completely succeed in the first attempt However, about the year 1768, a simple contrivance was attempted, which was to make a number of smaller wagons, and link them

* A stock of one hundred thousand horses renewed every four years, the keep and interest of capital included, amounts, in twelve years, to the prodigious sum of thirty-four millions seven hundred thousand pounds.

together; and by thus diffusing the weight of one large wagon into many, the principal cause of the failure in the first instance was removed, because the weight was more divided upon the iron. In 1797, these roads having stricken the minds of intelligent men as of great importance, numerous essays appeared, setting forth their utility, and as many plans for rendering them of permanent construction. Hence, cast iron railroads became a second desideratum to canals; excepting only that the invention is due to Englishmen.

"After this time the cast-iron railways began to be constructed as branches to canals, and in some places as roads of traffic from one place to another, established upon permanent principles, so as to produce a permanent revenue to the undertakers. In surveying a line to set out a railway upon, it will be necessary, as a preliminary step, to ascertain, as accurately as the nature of the thing admits, the quantity of lading expected to traverse each way upon its line; because, in forming the slope or descent, this will be the data on which to ground a medium for effecting the required purpose most easily.

"If it should turn out that as much lading is expected one way as the other, with a preponderance at periods only, the railing must in such a case be set out in levels, or in lines nearly level, and the ascents and descents made by planes inclined accordingly. Previously to beginning any part of the work, that is of laying the sleepers, &c. for the iron rails, a rough sketch or section of all the different routes intended to be passed by the railway should be made, from which, and a view of the ground, the engineer will be enabled to determine the place, and also the extent of the inclined planes which will be required in passing the steeper parts, or the rising ground to which these planes are to be employed; it will always be desirable to get them as short as the site of the place will admit.

"When sudden valleys present themselves approaching to higher ground, it will be necessary so to conduct the line as to cut into the hill at each side, and the cutting from the latter will be useful in raising the road-way of the former. On approaching rivers or brooks, which it is determined to pass, it will be necessary to keep up the rail road to a higher level by embankments, and on passing the water to raise a platform on purpose for it, composed of piers of masonry or columns of iron, with a covering of iron also to receive the rails; or a bridge altogether silar to an aqueduct bridge will answer the purpose. Railways may be divided into single and double: by the former are understood, when a single road only is formed; by the latter, when two or more are made for the ready passage of wagons up and down the road. Single roads are generally made, including horse and attendant paths, four yards wide;—and double ones vary from six to eight yards wide, exclusive of all the common appendages of such roads of drains, fences, &c. &c.

"Every tram or rail-road must be provided with passing places; a passing place consists in forming large plates of cast-iron, in such a manner as to admit of common rails being joined to them, and which will allow the wagons traversing the road to pass off into another or adjoining track. The cast-iron plates at the passing places should be somewhat stronger than the common rails, as at the passing places there is the greatest wear and tear upon the whole line. The iron moveable tongues should be of wrought-iron, and made about two feet six inches, or three feet long, standing up upon the plate equal in projection to the highest part of the rim of the common rails. It should be on a good strong axis or pin, that it may be strong and yet allow of being easily turned round, which it will require to be every time the wagons are passing by the different tracks up and down the railway. In passing deep descents, pieces of cast or wrotght iron must be provided, called sledges or slippers: these are provided to be placed under the

wheels of the wagons, to prevent their too rapid descent, and are similar in principle to the same kind of instrument made use of, and appended to our road wagons, for putting under the wheels on their going down a hill. When the whole iron railway is fixed, and levelled to the satisfaction of the engineer, it will be necessary to begin to prepare the horse and attendant paths; the foundation of the former should be, if possible, composed of good lime-stone, broken into small fragments, and strewed to the consistence of at least from ten inches to fourteen inches in thickness, rather convex towards the centre of the path; upon this, large screenings of gravel should be laid; the attendant path should be firm and regular, with a gravelly surface. The horse tracks and rails ought to be always kept clear and free from soil, which is constantly collecting on rail-roads of great traffic; and they ought also to be properly drained and kept dry at all seasons of the year; as on this, in a great measure, will depend their substantiality, and, of course, their utility.

"With respect to the wagons employed on iron rail roads, those in most general use are so constructed, that their weight, including their lading, does not exceed three tons and a quarter.

"This is found, by experience, to be the most eligible size; as the rail roads retain their shape without much dilapidation, by the use of wagons, equal to such weight. The wheels of the wagon are made of cast iron, two feet five inches high, having twelve spokes, which increase in width as they approach the hub, or centre of the wheel. The hub is eight inches long, and receives an axle of wrought-iron; the rims of the wheels are two inches broad. The axles of the wheels are fixed at two feet seven inches distance from each other; the bodies of these wagons are seven feet nine inches long, four feet five inches wide, and two feet four inches deep; and this sized wagon is calculated to contain the quantity of coal or other matter, equivalent, with the wagon added to it, to make a weight altogether amounting to three tons and a quarter, as before stated, as the most eligible weight to move upon a cast-iron rail road.

"In the Philosophical Magazine, July, 1811, are the following remarks concerning wagons, and also rail roads, from which some idea may be formed of the utility of such roads.—'The wagons on our cast-iron rail roads, have not received the improvements of which they are capable; but, with their present disadvantages, the following facts will evince the great saving of animal force to which railways have given rise:—First, with a declivity of one and a quarter inch per yard, one horse takes downwards three wagons, each containing two tons.—Second, in another place with a rise of 1 6-10th of an inch per yard, one horse takes two tons upwards.—Third, with eight feet rise in 66 yards, which is nearly one-fourth of an inch per yard, one horse takes two tons upwards.—Fourth, on the Penrhyn railway (same slope as above) two horses draw downwards four wagons containing one ton of slate each, Fifth, with a slope of fifty-five feet per mile, one horse takes from twelve to fifteen tons downwards, and four tons upwards, and all the empty wagons.—Sixth, at Ayr, one horse draws an a level five wagons, each containing one ton of coal.—Seventh, on the Surrey railway, one horse, on a declivity of one inch in ten feet, is said to draw thirty quarters of wheat.—From these cases, and the known laws of mechanics, we may, perhaps, safely infer, that where the apparatus is tolerably good, and well constructed, and the slope ten feet per mile, two horses may draw five tons upwards, and seven tons downwards.

"'The principal railways in England and Wales are, the Cardiff and Merthyn, twenty-six and three-quarter miles long, and runnning near the Glamorganshire canal; the Caermarthen; the Sexhowry, 28 miles, in the counties of Monmouth and Brecknock; the Surrey, 26 miles;—the Swansea, 7 1-2; one between Gloucester and Cheltham; besides several in the north of England.'"